

Prevalence and risk factors of Otitis Media with effusion among preschool children in Arar city, Saudi Arabia

Prevalence and risk factors of otitis media with effusion among preschool children

Yahia Elboraei¹, Ahmed M. S. Hegazy², Basem M.M. Salama³, Raed Alanazi⁴

¹ Department of Otorhinolaryngology, Faculty of Medicine, Northern Border University, KSA

² Department of Anatomy, Faculty of Medicine, Northern Border University, KSA and Benha Faculty of Medicine, Benha University, Egypt

³ Department of Family & Community Medicine Faculty of Medicine, Northern Border University, KSA and

Department of Community Medicine, Damietta Faculty of Medicine, Al-Azhar University, Egypt

⁴ General practitioner, Prince Abdul-Aziz bin Musaed Hospital, Arar, KSA

Abstract

Aim: This study aimed to determine the prevalence and risk factors associated with OME among preschool children. An insight into the factors associated with OME helps in the increase of awareness and helps to take appropriate steps in decreasing the occurrence of this disease among preschool children.

Material and Methods: This nested case-control, hospital-based study was conducted between December 2018 and December 2019 in hospitals, in Arar city, Northern Border Region, Saudi Arabia.

Results: A total of 530 children aged less than 6 years were randomly selected. The prevalence of OME was 6.8%. There is a statistically significant ($P < 0.05$) relationship between OME and bottle-feeding, parent's education, daycare attendance, passive smoking, allergic rhinitis, history of acute OM, nasal discharge, recurrent URTI, recurrent tonsillitis. In multivariate regression analysis, the following five factors were found to be independent predictors of OME: Nasal discharge (OR=4.9), allergic rhinitis (OR=5.5), bottle-feeding (OR=5.8), snoring (OR=3.2) and past history of acute OME.

Discussion: The prevalence of OME was 6.8% and nasal discharge, allergic rhinitis, bottle feeding, snoring and history of acute OM were the independently predictors of OME.

Keywords

Case-Control study; Otitis Media; Risk factors; Ear-Nose-Throat

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Corresponding Author: Yahia Elboraei, Department of Otorhinolaryngology, Faculty of Medicine, Northern Border University, KSA.

E-mail: yahiaelborai@yahoo.com P: +96656841264

Corresponding Author ORCID ID: <https://orcid.org/0000-0002-3975-1990>

Introduction

Otitis media with effusion (OME) is a middle ear disease characterized by the presence of mucoid effusion in the middle ear without any sign or symptoms of infection [1]. Hearing impairment is usually mild and is often identified when parents express concern regarding their children's behavior, success at school, or language development [2]. The presence of fluid in the middle ear leads to impaired mobility of tympanic membrane (TM) and conductive hearing loss with resultant poor speech and language development which are very important public health problems [3].

Many medical and anatomical abnormalities have been noted to increase the risk of OME [4]. Children with cleft palate have been known to have a higher incidence of OME at all ages especially during the first two years of life due to poor functioning of the Eustachian tube (ET) from the impaired insertion of the Tensor veli palatine muscle into the soft palate [4,5]. Children with congenital or acquired immunodeficiency often have difficulty in fighting and clearing infections, which makes them more susceptible to OME [4].

Adenoid hypertrophy causes mechanical peritubal obstruction of the pharyngeal end of the Eustachian tube [4-7]. It also causes a decrease in the number of T-Helper cells, which causes compromised immunological response in children, impaired adaptive immunity, leading to the spread of infection to the Eustachian tube [6]. Nasal allergy causes mucosal edema and narrowing of the ET lumen, thus leading to changes in middle ear pressure and resultant effusion [8]. Parents with low educational status and overcrowding homes are known to increase the risk to OME due to the impact of poor hygiene and an increase in the susceptibility to acquiring infection [9].

Other conditions that can increase the risk of OME include recurrent upper respiratory tract infection, exposure to cigarette smoke, bottle-feeding, males, increased family size, daycare attendance, familial predisposition, and winter season [10]. Systematic literature reviews had noted these risk factors to be controversial [10]. However, many authors had identified Eustachian tube (ET) dysfunction as the cornerstone in the pathogenesis of OME [11]. The tube is shorter, more horizontal, and straighter in young children making it easier for bacteria to enter. Not only that, but the tube is also floppier, with a tinier opening that is easy to block [4]. The ET has been traditionally described to provide 3 main functions: equilibration of pressure between the middle and external ears, clearance of secretions, and protection of the middle ear. Its dysfunction can be caused by any number of circumstances from anatomic blockage to inflammation secondary to allergies, upper respiratory tract infection (URTI), or trauma [4]. Small children get more colds because it takes time for the immune system to be able to recognize and ward off cold viruses. Other risk factors such as upper respiratory tract infection and allergy lead to edema and narrowing of the ET lumen [4]. If ET dysfunction is persistent, a negative pressure develops within the middle ear from the absorption and/or diffusion of nitrogen and oxygen into the middle ear mucosal cells. This negative pressure elicits a transudate from the mucosa, leading to the eventual accumulation of a serous, essentially sterile effusion. Because the ET is dysfunctional, effusion becomes a good medium,

ideal for the proliferation of bacteria and resultant acute otitis media. This classic model is somewhat incorrect; as multiple studies have revealed that the same pathogenic bacteria are present in otitis media with effusion as in acute otitis media [3,4]. Once OME has been established, the normal flat cuboidal middle ear mucosa is patchily replaced by thickened pseudo-stratified epithelium with varying degrees of specialization [4]. Several studies on the risk factors of OME have been carried out in developed countries [2, 8, 9, 12]. These risk factors remained controversial thus, necessitating this research.

This study aimed to determine the risk factors associated with OME among preschool children in Northern Borders Region, KSA.

Material and Methods

Study Design:

Nested case-control, hospital-based study was undertaken between December 2018 and December 2019 in Arar Hospitals, Arar city Northern Border Region, Saudi Arabia, comparing a group of preschool children having OME with a control group free from OME.

Study Population:

Five hundred thirty children aged less than six years were included in this study. The sample size was determined using the formula for population studies based on the prevalence of 9%, with a confidence interval (CI) of 95% and a significance level of 5%. $n = (z^2 p (1-p)) / d^2$.

A clinical examination of the ear, nose, and throat (ENT) was carried out for all preschool children attending the outpatient clinic (otoscopic examination was performed followed by tympanometry examination for children suffering from OME). Children suffering from otitis media (abnormal retracted tympanic membrane, fluid level or air bubbles) was considered as a case group. Only 36 cases were diagnosed as OME (these cases comprised our study group). For each case (OME), four controls (144 children) were randomly selected from the same population for analysis of risk factors.

Ethical issue:

This study was approved by the ethical committee of Deanship of Scientific Research, Northern Border University. Informed consent was taken from the parents of all recruited children. They were informed that all collected data will be used for scientific purposes only.

Data collection:

Information was collected from participant's parents using structured interviewing questionnaire including following data: child's age and gender, number of family members, mother's education, type of feeding in the first 2 years of life (bottle, breast or both), exposure to passive smoking, preschool daycare attendance, nasal discharge, and snoring

Statistical analysis:

Statistical analysis was performed using SPSS computer software (SPSS Version 16 for Microsoft Windows), appropriate statistical tests were used for the comparison between the two study groups. Either χ^2 or Fisher's exact test was used to compare categorical variables and an independent t-test was used to compare continuous variables. Odds ratio and 95% CI for it were calculated. A multivariate analysis was also

Table 1. Risk factors of otitis media with effusion among preschool children

Risk factors	Case		Control		(OR)	P-value
	N=36	%	N=144	%		
Gender (male)	10	28	30	21	1.5	0.4
Age (mean)	3.4 + 0.9	-	3.7 + 0.87	-	-	0.07
Number of family children (>4)	13	36.0	35	24	1.8	0.15
Socioeconomic status (low or moderate)	21	58.0	80	56.0	1.1	0.7
Mother education						
Below Secondary Education	17	47.0	33	23.0	3.0	0.004
Father education						
Below Secondary Education	15	42.0	35	24.3	2.2	0.04
Bottle feeding (before 6 months)	24	67.0	40	28.0	5.2	0.001
Congenital anomalies	3	8.0	5	4.0	2.5	0.2
Day-care attendance	15	42.0	35	24.0	2.2	0.038
Passive smoking	19	53.0	48	33.0	2.2	0.03
Allergic rhinitis	20	56.0	53	37.0	2.1	0.04
Siblings with OM	4	11.0	11	7.0	1.5	0.5
History of acute OM	11	31.0	22	15.0	2.4	0.034
Nasal discharge	26	72.0	66	46.0	1.4	0.005
Snoring at night	18	50.0	46	32.0	2.1	0.043
Recurrent URTI	22	61.0	59	41.0	2.3	0.03
Recurrent tonsillitis	16	44.0	30	21.0	3.0	0.004

performed. Results were considered statistically significant at $p < 0.05$.

Results

A total of 530 preschool children aged less than 6 years (the mean age of the case group in this study was 3.4 years and the mean age of the control group was 3.7 years) were included in our study. The prevalence of OME was revealed as 6.8%. OME was bilateral in 11 cases (30.5%) and unilateral in 25 cases (69.5%) without a statistically significant difference between the two groups regarding gender, age, or socioeconomic status ($p > 0.05$).

Table 1 shows that children who attended a daycare center were likely (OR=2.2 and $p=0.04$) to develop OME than children who did not attend. Exposure to household tobacco smoke (passive) appeared to have a significant relationship with OME ($p=0.03$). OME was significantly more in families with parent's education less than secondary school education ($p < 0.05$).

The type of infant feeding (bottle) during the first two years of life had a highly significant association (OR=5.2 and $p=0.001$) with OME in preschool children. History of previous OM was present in 11.0% of children with OME compared to 7.0 % of normal children ($p = 0.03$). Nasal discharge and snoring were statistically higher in children with OME compared to normal children ($p=0.005$, and $p= 0.03$) respectively. Also, the history of recurrent upper respiratory infection and tonsillitis were statistically associated with OME ($p=0.03$, and $p= 0.004$) respectively. While in multivariate regression analysis, the following five factors were found to be the only independent predictors of OME: nasal discharge (OR=4.9), allergic rhinitis (OR=5.5), bottle-feeding (OR=5.8), snoring (OR=3.2) and history of acute OME (Table 2).

Table 2. Multivariate logistic regression analysis of risk factors of OME

	P-value	Adj. OR	CI (95%)
Nasal discharge	0.007	4.9	1.55-15.5
Allergic rhinitis	0.007	5.5	1.6-18.9
Bottle feeding(before 6months)	0.01	5.8	1.52-22.4
Snoring at night	0.03	3.2	1.3-9.3
History of acute OM	0.03	4.3	1.19-15.2
Father's education	0.064	3.2	0.94-10.9
Recurrent tonsillitis	0.08	3.5	0.86-13.9
Number of family children (>4)	0.101	2.6	0.83-8.1
Siblings with OM	0.11	0.3	0.071-1.3
Recurrent URTI	0.12	2.1	0.72-6.2
Daycare attendance	0.19	2.1	0.69-6.48
Socioeconomic status	0.19	3.3	0.56-19.4
Mother's education	0.309	2.1	0.5-8.4
Congenital anomalies	0.394	2.4	0.32-18.3
Passive smoking	0.395	1.7	0.49-6.3
Gender	0.52	0.6	0.145-2.64
Age	0.58	0.6	0.130-3.1

Discussion

OME is the commonest cause of hearing impairment in young age children worldwide, which can affect the development of language or result in behavioral problems. The concentration on the preventive risk factors can improve the early diagnosis of OME, therefore, reduce the associated morbidity.

In this study, we found that 6.8% of children (36/530) suffered from persistent OME (> 3 months) in at least one ear. Rushton et al. reported the prevalence of 9.5% for Caucasian and 5.3% for Chinese primary school children [13]. Also in a study

from Sicily, comprising 2097 children aged from 5 to 14, the prevalence of OME was reported as 6.8% [14]. While Holmquist et al. in a study from Kuwait comprising 893 children of similar age, reported the prevalence of OME as 31.3% [15].

Children attending a daycare center suffered from OME more than other children who did not attend daycare center. This difference was statistically significant which agree with Baljošević et al., [14] who found that children who attend daycare are more often exposed to ear infections and respiratory infections.

Exposure to household tobacco smoke appeared to have a significant effect on persistent OME. These results agree with the results of Ceylan et. al., who found that cigarette smoking may lead to effusion by affecting both the mucociliary transport system and the normal opening of the Eustachian tube [16].

In our study, the type of infant feeding (bottle) during the first two years of life had a significant effect on the prevalence of OME in school years. These results go hand in hand with many researches who have found that breast-feeding protects against infections [17, 18].

There was no statistically significant influence of family size on the prevalence of OME. These results agree with the results of Aydemir and Ozkurt [19] who found that the number of siblings and family members was not related to OME.

OME was significantly more common in families with a mother's educational level less than secondary school. This results in consistent with other studies [20] which reported a significant association between OME and parent education. On the other hand, Aydemir and Ozkurt [19] results disagree with our results because they found that the educational level of the parents was not related to OME. This may be due to the coverage area of each study.

The history of previous OM was higher in children with OME compared to normal children. These results go hand in hand with Baljošević et al. [14] who found that children with recurrent OME had a significantly higher rate of allergy than children with no recurrence.

Nasal discharge and snoring were statistically higher in children with OME compared to normal children. These results go hand in hand with other studies [21, 22] which found that OME was significantly related to snoring, that may indicate a link between nasal congestion and OME.

Recurrent upper respiratory infection was significantly different between both groups. These results go hand in hand with the previous study which stated that many risk factors have been associated with OME such as mother's low education level, low socioeconomic status, day-care attendance, parental smoking, upper respiratory tract infections, allergy and snoring [23,24]. In our study, OME was not significantly associated with gender. This finding is in agreement with Kucur et al. [2] who found no significant difference between males and females.

Conclusions:

The prevalence OME was 6.8% and nasal discharge, allergic rhinitis, bottle feeding, snoring and history of acute OM were the independent predictors of OME.

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Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

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